2. PROPOSED ACTION AND ALTERNATIVES

This Chapter of the Site-Wide EA describes the Proposed Action and No Action Alternatives. Other alternatives were considered prior to and during the scoping period. Those alternatives and the rationales for eliminating them from further consideration in this EA are described in Chapter 1.

As described in Chapter 1, Appendix A, and NREL's web site: http://www.nrel.gov/esh, NREL has made extensive management commitments to address environmental, safety and health issues associated with developing, operating and managing the NWTC. These commitments include implementing an environmental management policy and risk assessment policy to address and prevent off-site impacts and proactively manage on-site activities to minimize any risks to the environment, safety, and health. In support of these policies, NREL has a specific set of environmental management programs, numerous environment, safety and health (ES&H) programs, and specifically proposed measures to avoid or minimize ES&H impacts. These commitments are considered baseline conditions with respect to the short-term and long-term improvements described in this Chapter, the affected environment described in Chapter 3, and the impact analysis presented in Chapter 4. All Proposed Action components would be implemented consistent with these commitments.

2.1 PROPOSED ACTION

The Proposed Action is to operate the NWTC for alternative energy research with new and improved capability to support DOE's mission to research and develop renewable energy technologies. New construction would include permanent physical improvements to the site that involve buildings and equipment, utilities, and other infrastructure. The Proposed Action also includes activities that do not require permanent facilities or infrastructure, such as research programs, facility operations, management practices and maintenance activities.

The components of the Proposed Action are divided into two implementation periods:

1. Short-Term (2002-2006)
2. Long-Term (2007-2021)

The actual schedule for implementation of the site improvements is dependent on federal budgeting decisions and fluctuating priorities, therefore the Proposed Action cannot be specific with respect to actual construction schedules. In addition, certain site planning and architectural details are tentative and subject to modification. Consequently, those actions most likely to occur in the short-term implementation period are analyzed based on information available at this time, and the analyses recognize that some modifications would be expected.

The long-term wind research and distributed energy facility infrastructure improvements have been defined in less specific terms because of uncertainties in future funding and a lack of details available at this time. Therefore, this EA employs a "bounding analysis" approach to evaluating potential environmental impacts resulting from an array of potential development options within a conceptually defined site "buildout" scenario. This potential scenario may never occur, or it could change to involve more or less development. The purpose of this approach is to promote a comprehensive assessment of potential impacts from future site use and development.

2.1.1 Short-Term Components (2002-2006)

Improvements comprising the short-term component of the Proposed Action are listed below, followed by a more detailed description of each proposed improvement. Figure 2-1, *Proposed Site Improvements: Short-Term (2002-2006),* presents proposed short-term site improvements and facility characteristics. Appendix B presents technical information and references for further information about the wide range of wind turbine, solar, hybrid and other kinds of activities, facilities and equipment that might be used or tested at the NWTC.

Facility and Research Area Modification and Construction

- Expansion of the Structural Blade Testing Facility and/or Construction of a New Facility.
- Expansion of the Dynamometer Test Facility and/or Construction of a New Facility for Testing Larger Turbines.
- Installation of Three New Large (Megawatt-Class) Turbines, Additional Smaller Turbines and Associated Facilities.
- Installation of 20 Additional Test Sites.
- Construction of a Distributed Energy Resources Test Facility (DERTF).
  - Phase 1: Construction of a Systems Interconnection Test Lab.
  - Phase 2: Construction of a Hybrid and System Test Lab.
  - Construction of a DER Test Area.
- Installation of Several Large and Small Solar Dish/Converter Systems.
- Fuel Cell Thermal and Moisture Management Research.
- Installation of a 25kW Electrolyzer System.
- Renovation of the East Wing of Building 251 and 253A.
- Modification of Existing Facilities.

Infrastructure Improvements

- Upgrade the Existing Electrical Infrastructure.
- Extend Natural Gas Pipeline from Highway 93 to the Site.
- Upgrade and Extend Telecommunications Infrastructure.
- Upgrade Existing Domestic Water System.
- Upgrade Fire Protection System.
- Upgrade Sewage System.
- Upgrade and Modify On-Site Roads, Parking Areas, and Site Entrance.
- Implementation of Security Improvements and Modifications.

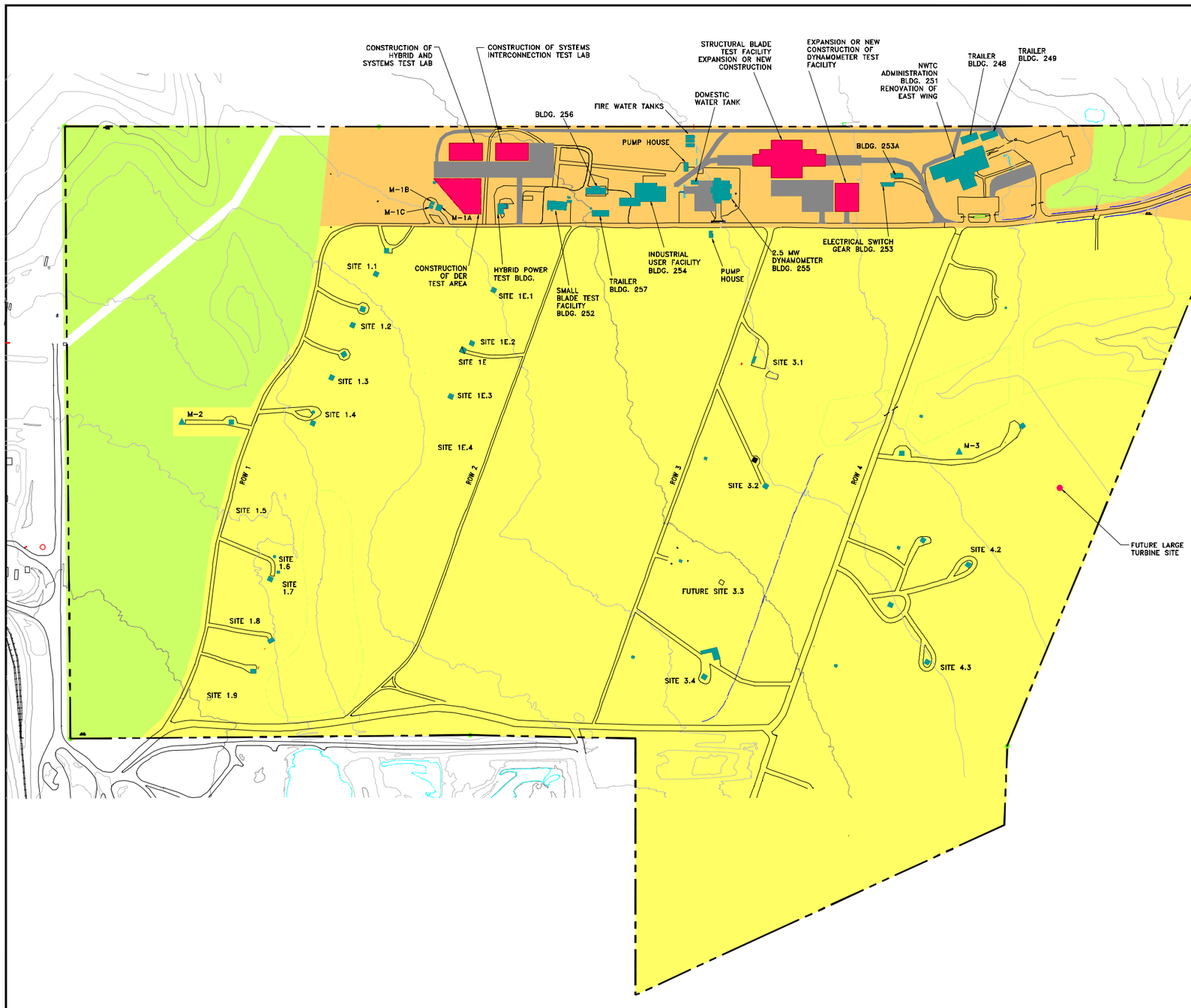

Figure 2–1
Proposed Site Improvements:
Short–Term (2002–2006)

TEST SITE AREA – PRIMARY IMPROVEMENTS

- 3 NEW MEGAWATT CLASS TURBINES, SMALLER TURBINES AND ASSOCIATED FACILITIES
- 20 ADDITIONAL TEST SITES

NOTES:

1) SEE SECTION 2.2.1 FOR A COMPLETE LIST OF SHORT–TERM IMPROVEMENTS
2) SOME FACILITY LOCATIONS HAVE NOT BEEN SPECIFIED AT THIS TIME
3) FACILITY LOCATIONS ARE APPROXIMATE AND MAY CHANGE

GENERAL NOTES:

1. VARIOUS SITE SHEDS AND MET TOWERS NOT SHOWN FOR CLARITY.

LEGEND:

- RESEARCH & SUPPORT FACILITIES AREA
- TURBINE TESTING AREA
- CONSERVATION MANAGEMENT AREAS
- EXISTING BUILDINGS AND FACILITIES
- FUTURE BUILDINGS AND FACILITIES
- FUTURE VEHICLE ACCESS AND PARKING

0 100 200 300 400 500
SCALE IN FEET

BASE MAP SOURCE: NREL, 2001
FILE NAME: SHORT TERM NEW.dwg
DATE: 5/09/02

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Site Activities and Routine Maintenance

- Office and Lab Work.
- Installing and Removing Wind Turbines, Distributed Generation Equipment, Meteorological Towers and Instrumentation, and Installation of the Necessary Infrastructure.
- Maintenance and Monitoring of Atmospheric and Wind Turbine Experiments, Distributed Generation Experiments, Tests and Certifications.
- On-site Environmental Monitoring.
- Upgrades to Site Amenities.
- Fuel Storage and Use.
- Routine Tasks.

The following discussions provide a detailed description of the short-term actions listed above.

Facility and Research Area Modification and Construction

- **Expansion of the Structural Blade Testing Facility or Construction of a New Facility.** This improvement would allow testing of larger blades, provide the capability of a wind tunnel, add approximately 5,000 square feet of office space, and add about 20,000 square feet of research area. The new blade test facility would provide the capability to test large wind turbine blades (up to approximately 231 feet (70 meters) in length).

  The facility would be either a freestanding building or a modification to the existing Industrial User Facility (IUF). The associated high-bay would be larger than the current IUF high-bay in order to accommodate larger blades. The facility would be designed for dual or multi-purpose use.

  The foot print area necessary, whether in a freestanding facility or a modification to the IUF for blade testing, would be approximately 25,000 square feet. Office space for approximately 20 to 25 staff would be provided.

  Electrical requirements for this facility could be accommodated within the current capacity of electrical service. However, modifications to the NWTC site electrical infrastructure would be required. The NWTC water system would have to be enlarged for fire protection and domestic water, and additional sewage disposal capacity would be needed.

- **Expansion of the Dynamometer Test Facility or Construction of a New Facility for Testing Larger Turbines**. This facility would be a larger version (8 to 10 MW capacity) of the existing 2.5 MW Dynamometer Test Facility constructed at the NWTC in 1999. It would contain equipment very similar but somewhat larger than the current facility. Examples of larger equipment to operate this new facility would be the variable frequency drive (VFD), AC motor, and speed reducing gearboxes. An 8 to 10 MW facility would be approximately 35 percent larger (physically) than the existing Dynamometer facility.

  The facility would include the ability to regenerate electrical power from test articles. This facility would be necessary to test the rotor/drive-train/generator components, as well as complete assemblies including the control electronics of the commercial utility megawatt-class machines prototyped and produced by the wind industry. The facility could also be used to test turbines (generators) designed for underwater use. An infrastructure upgrade

to support 10 MW of electrical power in addition to the current 10 MW capability would likely be installed prior to or concurrent with the installation of a new large MW Dynamometer.

- **Installation Of Three New Large (Megawatt-Class) Turbines, Additional Smaller Turbines and Associated Facilities.** Three megawatt-class turbines and additional smaller turbines and associated facilities would be constructed at the site.

  Table 2-1 compares these larger turbines with the largest existing turbines on the site at this time:

Table 2-1. Turbine Rotor Diameters and Hub Heights

Turbine	Rotor Diameter *		Hub Height	
	Feet	Meters	Feet	Meters
0.6 Megawatts ** (existing)	142	43	120	36
1.5 Megawatt	218-248	65-75	264	80
5.0 Megawatt	347-363	105-110	413-446	125-135

* Low wind-speed sites use larger rotors than high wind-speed sites. Any or all of these rotor diameters could be installed at the NWTC for experimental purposes.

** 0.6 Megawatts = 600 kilowatts

  Foundation types vary. Some of the larger ones could require excavations measuring about 75 feet (22.7 meters) on each side. The larger the turbine and blades, the greater the spacing required between turbines. For these megawatt-class turbines, a spacing of roughly 2,310 feet (700 meters) between turbines would be needed in the upwind direction. Precise spacing distance would be calculated based on the specific locations and turbines to be tested. Turbine field tests would require upgrades of the existing buried cable infrastructure and extension of that infrastructure to the prospective sites. The increased service capacity for megawatt-class turbines by themselves would not necessitate increasing service from Xcel Energy to the NWTC.

- **Installation of 20 Additional Test Sites.** This improvement would add additional test sites within the designated test site area. Installation of test sites involves utility service extensions, temporary heavy equipment access, and construction of foundations and pads for future use. These additional test sites would be added as necessary, and are likely to address various research requirements; therefore, they may not be identical or added simultaneously.

  A typical wind turbine test site is comprised of a turbine, one or more small test buildings to house equipment, and several ancillary towers for such things as meteorological equipment, video equipment, and lightning protection. Other supporting structures and equipment may be added as needed for specific research projects, such as equipment needed to test hybrid power or distributed energy technologies.

- **Construction of Distributed Energy Resources Test Facilities.** These improvements would provide buildings and a field test area to develop and validate information, data, and testing standards to strengthen NREL's core expertise and capabilities in several technical areas regarding the new Distributed Power Program within the new DER Center. In addition, the improvements would aid manufacturers of distributed generation equipment through cooperative testing of their systems for baseline comparisons to identify advances

in functional performance. Completing these improvements would enable NREL to enhance its position and expertise in this new energy arena.

Phase 1: Construction of a System Interconnection Test Lab. This improvement would create 10,000 square feet of space to enhance distributed energy research. The facility would allow the development and validation of interconnection standard testing methods and procedures, electrical details, safety standards, and grid compatibility.

Phase 2: Construction of a Hybrid and System Test Lab. This improvement would add another 10,000 square feet of space for distributed energy research adjacent to the proposed System Interconnection Test Lab. The facility would be focused on long-term performance, reliability, availability, fuel efficiency, and emissions of clean energy systems, and would involve testing of advanced design technologies. These systems would include technologies such as photovoltaic, wind, fuel cell, micro turbine, concentrated solar power, storage, combined heat and power, modular biomass, and other technologies in both generation independent and hybrid applications.

Requirements for each phase would include: approximately 10,000 square feet of space; a fire access lane and connection to the site fire protection system with possible upgrades; a domestic water system connection with possible upgrades; a natural gas line (at least intermediate pressure 55 (PSIG) to run turbines; a new sewage disposal system; telecommunication lines; electrical service; the capability for 1MW to 10 MW testing output back to the utility grid and/or load banks; approximately 15 parking spaces per building with a paved delivery area; and an access road to connect each building to the existing paved site road. It is expected that a hydrogen tank would be installed as an alternate fuel source at one of the buildings.

The facilities would be located north and west of the existing HPTB. Both DER buildings would be adjacent to one another. Building design would maximize energy efficiency, integration into NWTC architecture, and aesthetics.

It is expected that when Phase I is complete, 10 employees from the new DER Center would be housed in the building. Upon Phase II completion, an additional 10 employees would be housed in the Phase II building.

Expected routine work in these facilities would include conducting tests on electrical power generation and storage equipment. This testing may include, but is not limited to, high voltage testing, electrical surge testing, electrical islanding testing, equipment qualification testing, and performance and reliability testing.

Construction of a DER Test Area. This improvement would allow field testing of advanced design technologies including the following technologies, among others: photovoltaic, wind, fuel cell, micro-turbine, concentrated solar power, storage, combined heat and power, modular biomass, and other technologies in both generation independent and hybrid applications. It would most likely be located south and/or east of the DER buildings, and would provide space for distributed generation equipment test pads. The DER test area may also include typical electrical distribution equipment such as overhead lines, transformers, reclosers, sectionalizers, and capacitor banks. This equipment would be used to stimulate and test electrical distribution feeder configurations.

- **Installation of Several Large and Small Solar Dish/Converter Systems (Large Solar Dish/Converter System Short Term Testing).** This set of improvements would generate 2 to 2.5 kW of power each from concentrated sunlight and involve systems testing. Dish/converter systems require a converter (i.e. Stirling or concentrating PV) located at the point of focus of a parabolic-shaped concentrator.

  The program's current test facilities at NREL are limited to a small test site located adjacent to the High Flux Solar Furnace on the South Table Mountain site. The proposed NWTC location would provide additional space for performing short-term testing of large-scale systems and longer term testing of small-scale systems. The NWTC, with its high winds, is not compatible with long-term testing of large solar dish/converter systems. Several industry partners have expressed interest in deploying test systems at NREL.

  Dish location is flexible. The dishes could be located near existing buildings or within the test site area as long as the systems are not shadowed by each other or other structures. Dishes would not be located in any of the designated Conservation Management Areas.

  The maximum height of the solar facilities would be approximately 40 feet (12.12 meters).

- **Fuel Cell Thermal and Moisture Management Research and Testing.** This improvement would require 1,000 square feet of space to house fans, heaters, coolers, humidifiers, and dryers to test fuel cells for fuel cell thermal and moisture management projects. It may involve construction of a new facility or space allocation in an existing or modified existing facility. This project would allow testing of various thermal and/or moisture management designs and hardware for fuel cells to evaluate their effectiveness for improving the performance and efficiency of fuel cells for mobile and stationary applications. Prototype fuel cells would be tested.

  The project is needed to assess a key issue for thermal and moisture management in fuel cells for transportation and stationary applications. Without proper thermal and moisture management, fuel cell performance and efficiency could suffer. This research could provide a better understanding of the fuel cells for application in various programs, such as Transportation, Hydrogen, Photovoltaics, Wind, and Distributed Energy Resources.

  The potential fuel cells to be tested would range from about 5 kW to 55 kW. The work would also require a programmable electrical load for running fuel cells. Electricity requirements would be a conventional system with a potential draw of up to 20 kW. To run the fuel cells, hydrogen (from compressed cylinders or direct feed line from a hydrogen storage tank), or possibly other fuels such as ethanol or gasoline, would be used. Telecommunication, data, water and drainage improvements would also be needed. Ductwork to exhaust the emissions from the fuel cell (mostly water vapor) out of the building and hydrogen ventilation would be necessary.

- **Installation of a 25kW Electrolyzer (Renewable Energy-Hydrogen Hybrid Power) System.** An electrolyzer is a device to store energy in hydrogen. This activity would most likely be conducted at the Hybrid Test Facility or DER Test Area. Testing of an electrolyzer with wind and photovoltaic systems is proposed to assess the technical issues involved in using hydrogen as a storage medium for renewable energy systems, a key issue for

renewable energy generation. All renewable energy technology programs would benefit from a better understanding of the potential of hydrogen as a storage medium for intermittent energy generation systems.

- **Renovation of the East Wing of Building 251 and 253A**. This renovation would allow for all existing uses, while reallocating space for approximately 18 additional offices and a slight increase in space for the library. The office space would be a mixture of cubicles and enclosed offices. Additional library space would allow for storage of materials currently stored in temporary containers. There is insufficient office space in the existing facilities (Buildings 251 and 254) at the NWTC to house all of the research and support staff. Renovation of the east wing of Building 251 offers a viable alternative to constructing new buildings for offices. These offices are for staff members currently housed in trailers.

  The east wing was originally designed as laboratory and work shop space and therefore is not properly configured for office space. The infrastructure and building structural changes necessary are minimal since all of the current interior walls to be removed are non-load bearing, and there is sufficient electrical infrastructure to support any new loads. Heating, ventilation and air conditioning (HVAC) equipment would be the only major infrastructure necessary to adequately support the new offices.

  There is an option to renovate Building 253A (the former switchgear building that has been replaced) for the Facilities Building Technician and parts storage. The design also includes an option to make more wall space available in the electrical/mechanical rooms 116 and 115 for additional electric panels/terminations. The actual number and ratio of enclosed offices to cubicles would be determined by selection of options already designed during the scope and estimate phase. These options would be exercised at the time of the construction contract award.

- **Modification of Existing Facilities.** Existing facilities on the NWTC may be modified or expanded, including interior and exterior modifications or additions, to accommodate new research proposals or the supporting operations and activities.

Infrastructure Modifications and Improvements

The construction of new facilities and modification to existing facilities and research areas, and the need for technology upgrades, generates a series of infrastructure needs and proposed improvements. In addition to those noted in previous sections, the following infrastructure modifications and improvements are proposed:

- **Upgrade the Existing Electrical Infrastructure.** As the NWTC grows with new and larger research equipment being tested, the existing electrical system capacity would eventually become inadequate and a major electrical system upgrade would be necessary. This upgrade would require input from Xcel Energy to identify the closest adequate power source, likely power line route, required transmission line voltage, and required substation equipment. It is possible that the new electrical system upgrade transmission lines could enter the NWTC site at a different location from the existing transmission lines. It could then be routed to a different location from the existing underground utility corridor. All details concerning the electrical upgrade would be finalized during the design phase.

This increased capacity is necessary to install and test commercial turbines in the multi-megawatt utility-scale class and to support other on-site improvements. This capability would be necessary for integrated turbine tests, and to supply power and regenerative capacity for a proposed larger structural test facility and a larger dynamometer facility. It would also support other proposed improvements, such as the proposed DER facilities.

The increased capacity would most likely include increasing the service capacity of the overhead Xcel Energy feeder lines from Highway 93 to the NWTC property line. In addition, the buried 13.2 kV lines at the NWTC would have to be upgraded or replaced. Two infrastructure changes on NREL/NWTC property would be necessary.

The first change includes two options that may be implemented individually or in combination.

1. Option 1 would be to upgrade the current switchgear and buried 10 MVA cable coming into the existing switchgear building to 20 MVA. This option would likely require a 20-foot wide construction corridor and trenching from the west property line to Building 253 along the current buried cable path.

2. Option 2 would bring in a separate 10 MVA feeder line on the southern part of the NWTC property to feed the turbine sites from the separate line with different switchgear, or possibly a substation. This option would require new trenching across the southern part of NWTC property to install the switchgear or substation and connecting line to the existing turbine grid, as well as any new infrastructure installed for the new turbines.

The second change would be to add the buried electrical infrastructure, switches and transformers necessary at each of the new turbine locations on the NWTC to accommodate installation of the new machines and buildings such as a new Dynamometer.

Standby generator capacity would be evaluated with each new project proposal, and would be upgraded as needed.

- **Extend Natural Gas from Highway 93 to the Site.** This improvement involves two options for the alignment of a medium-pressure natural gas line to the NWTC site:

  1. Northern Option (Option 1) – 6,170 feet (1,869.5 meters) in length
  2. Southern Option (Option 2) – 7,050 feet (2,136.1 meters) in length

  As shown in Figure 2-2, *Proposed Options for the Natural Gas Line,* Option 1 would tap into the existing four-inch gas line located in a utility easement east of Highway 93 at a point just west of the site's southwestern corner. A new gas pressure regulating (REG) station would be added at or near the connection point. The alignment would follow Highway 93 north, turn east toward the site's western boundary, then follow an existing underground utility corridor in a northeasterly direction. The remainder of the alignment would follow an existing utility corridor along the site's northern boundary. The eastern terminus of the line for NWTC's purposes would be the connection to Building 251.
  Option 2, the Southern Route, is identical to Option 1 east of the point where both lines would meet the site's northern boundary. As shown in Figure 2-2, Option 2 would connect into the existing line south of the Option 1 connection point along Highway 93. The Option 2 alignment would head due east along an easement through open land on the LaFarge

aggregate processing site where it would then run along access roads and cross a railroad spur that serves the aggregate operations. The alignment turns north at the NWTC site's southwest corner and then roughly follows the most westerly access road (Row 1).

Xcel Energy, the local gas provider, has requested an easement across the site to Highway 128. Xcel would use the easement to install only the line needed by NWTC, and could use the easement to form a future service loop through the NWTC site. The pipeline is expected to be a medium pressure design using a polyethylene type piping material operating at a maximum operating pressure of 60 psig with a maximum standard metering pressure of 2 psig. A 20-foot wide construction easement would be required for the length of the pipeline route. Construction proposed for summer 2002 would terminate at Building 251.

This project would provide pipeline "stub-outs" for all of the major NWTC buildings. However, as funding becomes available, future projects would connect the existing buildings and convert electrical mechanical equipment to gas-fired equipment for space heating and domestic hot water usage. Future projects are expected to be served by the natural gas line and include conversions at:

- Building 251 space heating and domestic hot water to natural gas;
- Building 252 space heating to natural gas;
- Building 254 space heating and domestic hot water to natural gas;
- Building 255 space heating to natural gas; and
- Building 256 space heating to natural gas.

In addition, a natural gas vehicle fueling station would be constructed as funding becomes available.

The initial purpose of this pipeline is to support research activities involving micro turbines. Currently, propane is used for testing of micro turbines. If a natural gas line were installed, the micro turbines would operate on natural gas, although the capability to use propane on the NWTC site as a fuel in future research, operations, or vehicle applications may remain.

Upgrade and Extend Telecommunications Infrastructure. This improvement would involve installation of a copper and fiber optics spine to new or expanded facilities (e.g., Systems Interconnection Test Lab/Hybrid and Systems Test Lab, Large MW Dynamometer Test Facility, Large Structural Blade Test Facility) and test sites to support NWTC data and telecommunication requirements. A secure location would be developed to house additional network and telecommunications equipment.

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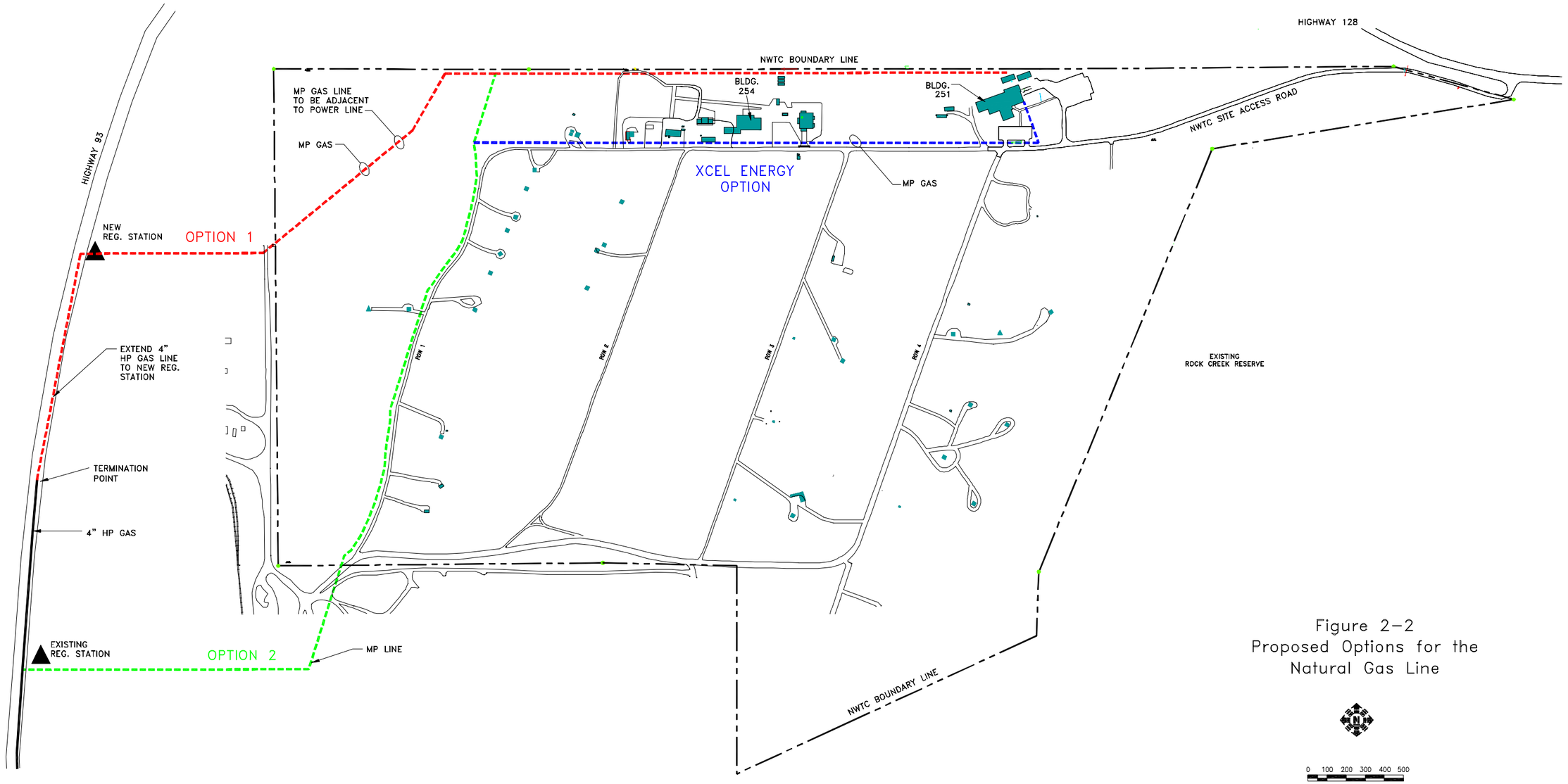

Figure 2–2
Proposed Options for the
Natural Gas Line

0 100 200 300 400 500
SCALE IN FEET

BASE MAP SOURCE: NREL, 2001
FILE NAME: GAS OPTIONS NEW.dwg
DATE: 5/09/02

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- **Upgrade Existing Domestic Water System.** The current water system involves delivery of water via truck and on-site storage. Proposed new facilities expected to require domestic water include the: Structural Blade Test Facility, Large MW Dynamometer Test Facility, System Interconnection Test Lab, and Hybrid and System Test Lab. These additional buildings, increased facility use and more on-site employees would require more frequent truck deliveries. Underground pipes would have to be installed from the domestic water loop to any new facilities requiring domestic water. It is also possible that additional tank storage capacity and associated equipment upgrades may be necessary. In certain circumstances, as in the case of a proposed facility outside the domestic water loop, an entirely new domestic water system would be installed.

- **Upgrade Sewage System.** Proposed new facilities are expected to require additional sewage disposal systems. The size of each septic tank and leach field would be based on maximum staffing and soil conditions surrounding each new facility site. Septic tank systems would be added as part of the following new facilities: Structural Blade Test Facility, Large MW Dynamometer Test facility, System Interconnection Test Lab, and Hybrid and System Test Lab.

- **Upgrade Fire Protection System.** The existing fire protection system is generally adequate for future buildings as identified. However, any new facilities would have to be connected to the fire protection system through underground piping, and additional fire hydrants would likely be needed, depending on final building locations. In addition, it is possible that additional tank storage would be required. Specific requirements would be identified during design of new facilities and projects. Development of test sites on the southern end of the site or facilities placed outside the fire protection loop may require installation of a new, separate fire protection system.

- **Upgrade and Modify On-Site Roads, Parking Areas, and Site Entrance.** On-site roads and parking areas would be resurfaced, upgraded, or modified in size or location, as necessary, to most effectively and safely support on-site activities. Access roads to new facilities and test sites would be installed. The site entrance at Highway 128 would be modified, as necessary, to provide safe site access and adequate traffic flow. This may include widening to provide additional acceleration and deceleration lanes on the highway, realignment of the on-site road or highway, widening of the on-site road, or other needed modifications. Any modifications to Hwy. 128 would be coordinated with the Colorado Department of Transportation.

- **Implementation of Security Improvements and Modifications.** Additional or modified site entrance protection improvements and perimeter protection improvements (fences) will be implemented, as necessary. These improvements and modifications would include: an approximately 10 foot (3 meters) by 16 foot (5 meters) guard station located immediately north of the current gate that would incorporate various renewable energy, energy efficiency features such as a trombe wall and a small (demonstration size) wind turbine. The trombe wall is a passive solar space heating feature.

Site Activities and Routine Maintenance

The following paragraphs document typical activities that are anticipated to occur routinely during the course of research and operations at the site. Many of these routine activities are currently ongoing and would continue at the same or an increased scale or frequency. Other activities listed below would be new.

- **Office and Lab Work.** Office-type work at computer workstations and activities associated with a variety of dry laboratory environments would be common. Destructive structural testing to failure of blades and blade components using hydraulic actuators and overhead cranes is a group of related indoor activities on-site. Also occurring indoors would be work at the 2.5 MW Dynamometer Facility, which involves testing of wind turbine components and integrated wind turbine drive trains. Other labs would conduct work on hybrid electrical systems using large electrical bus connections and computers. The work would involve power electronics design, assembly, bench testing, modal (vibration) instrumentation, calibration, and equipment maintenance. Some labs would be used for wind turbine component assembly. These components would then be tested within the labs or installed at one of the field test sites.

- **Installing and Removing Wind Turbines, Meteorological Towers and Instrumentation, and Installation of the Necessary Infrastructure.** Work at NWTC would require use of heavy equipment such as cranes, boom trucks, lifts, fork trucks, tractor-trailer trucks, backhoes, front-end loaders, flat bed trucks, as well as four-wheel drive pickup trucks. Installation and maintenance of meteorological instruments, towers, and turbines would be accomplished using lifts, boom trucks, and tower climbing equipment. Ancillary activities would include loading and unloading components, turbines, towers, and blades from trucks using hoisting and rigging equipment. Since only the main east-west road (West 119th Avenue) is paved, access to most of the active sites is over gravel roads. Other associated work, such as excavation for installation of concrete and electrical infrastructure, would require compaction, leveling and reseeding of the disturbed ground.

- **Installing, Testing, Monitoring, and Removing Distributed Generation Equipment and Installation of the Necessary Infrastructure.** Work at NWTC would require use of heavy equipment such as cranes, boom trucks, lifts, fork trucks, tractor-trailer trucks, backhoes, front-end loaders, flat bed trucks, as well as four-wheel drive pickup trucks. Other associated work, such as excavation for installation of concrete and electrical infrastructure, would require compaction, leveling and reseeding of the disturbed ground. Electricians, mechanical and electrical technicians, engineers, and management staff would monitor ongoing site research activities as required, and would perform necessary maintenance on equipment.

- **Maintenance and Monitoring of Atmospheric and Wind Turbine Experiments, Tests and Certifications**. Electricians, mechanical and electrical technicians, engineers, and management staff would monitor ongoing site research activities as required, and would perform necessary maintenance on equipment.

- **Site Amenities**. Site amenities would consist of improvements such as foot and bicycle trails, sidewalks, and outdoor gathering areas. These outdoor areas may include benches, tables, gazebos, or small recreation areas. Building 251 remains the primary administrative

building for the site and, as a result, would be the location of many staff and visitor amenities on the site. Other populated buildings would have outside gathering/amenity areas appropriate to staffing levels, as required. Wood fencing would be used to temporarily provide windbreaks and protect young trees as they mature into natural living windbreaks. Additionally, earth mounds and berms would be constructed to provide ground level protection from high winds. Sidewalks for pedestrian and bicycle traffic would be installed as needed.

- **Fuel Storage and Use.** On-site fuel storage and use could involve a variety of traditional and/or alternative fuels, such as propane, hydrogen, liquefied natural gas, ethanol, gasoline, diesel, biodiesel, and other diesel blends for research, site operations, and vehicle fueling. A Spill Prevention, Control and Countermeasures (SPCC) Plan is in place and will be updated as necessary for any additional fuels brought on site.

- **Routine Tasks.** This category of activities is comprised of tasks such as:

  - Cleaning facilities and equipment, both research and site operations;
  - Inspections and audits of systems, processes, and equipment;
  - Equipment maintenance;
  - Landscape maintenance (e.g. mowing, trimming, weeding, replacement of plants, upgrades, etc.);
  - System testing, preventive maintenance, repairs of systems and components;
  - Snowplowing;
  - Road maintenance;
  - Re-alignment of on-site roads, parking lots, and the site entrance at Highway 128, as needed, to maintain safe and adequate traffic flow;
  - Pest control, including control of such pests as rodents and insects;
  - Preventive maintenance including such items as changing air filters and testing diesel generators;
  - Corrective maintenance including such items as changing light bulbs, replacing leaking pump seals, resetting circuit breakers and performing minor repairs;
  - Troubleshooting malfunctioning items and systems related to facilities;
  - Coordinating outside subcontractors with such items as water testing, pest control, water deliveries, and crane inspections;
  - Providing historical information and technical recommendations concerning building and facility operations;
  - Maintenance, testing, upgrades, modifications, and additions to the fire protection system, including, but not limited to, installation of additional storage tanks, distribution piping and equipment, fire hydrants, and monitoring capability;
  - Maintenance, including water deliveries, testing, upgrades, modifications, and additions to the domestic water system including, but not limited to, additional storage tanks, additional distribution points (buildings), distribution piping and equipment, treatment equipment, and monitoring capability; and
  - Maintenance, testing, upgrades, modifications, and additions to wastewater handling capability at the site via individual sewage disposal systems including, but not limited to, new septic tanks, leach field additions and/or expansions, and other tasks.

2.1.2 Long-Term Components (2007-2021)

Long-term improvements are envisioned to take place beyond the 5-year time frame. Figure 2-3, *Proposed Site Improvements: Long-Term (2007-2021),* presents the proposed long-term site improvements plan. In keeping with the bounding analysis approach, more assumptions and fewer details are provided because these long-term actions are more speculative in nature. The facility construction, research, development, and testing currently planned for the NWTC is dependent on changing federal budgets and priorities, so actual schedules for the improvements may differ from those used in the impact assessment process. The schedule assumptions used in this assessment are the best estimates that can be made at this time, and are intended to generate maximized incremental and cumulative impact circumstances.

For purposes of long-term, site-wide environmental review, the following "bounding analysis" assumptions have been made to represent likely site "buildout" conditions.

- The portion of the site designated for permanent facilities is developed in a manner consistent with current land use designations.
- Only facilities and facility modifications presenting environmental consequences and risks approximately equivalent to existing facilities are added. No high-risk chemicals, processes or circumstances are added.
- Existing test sites are not converted to allow for additional permanent development.
- Conservation Management Areas remain conservation areas.
- Maximum building heights of 75 feet.
- 50,000 square feet of new laboratory, office and/or other support space (in addition to specific facilities discussed earlier in this chapter under short-term improvements).
- 300 total employees on-site.
- New on-site road connections and parking areas are constructed.
- Utility extensions are installed to new development site.
- No major, off-site road or utility services other than a permanent natural gas pipeline are implemented.
- Maximum individual turbine capacity is limited to 5 MW.
- No more than five large-scale (5 MW) turbines are located on the site at any one time.

Figure 2-3 presents a general representation of the area where buildings, parking areas, and other improvements would be located. Turbines and turbine test sites would be located south of this area.

2.2 NO ACTION

The No Action Alternative would leave the site in its current configuration, add no new facilities, and maintain current levels of research, operation and management activities.

This EA considers the existing site facilities and operations in 2001 to be the baseline condition for environmental impact analysis. This is a conservative approach because some of the improvements and operational parameters for the NWTC set forth in the 1996 EA were cleared under NEPA, but have not been constructed or fully implemented.

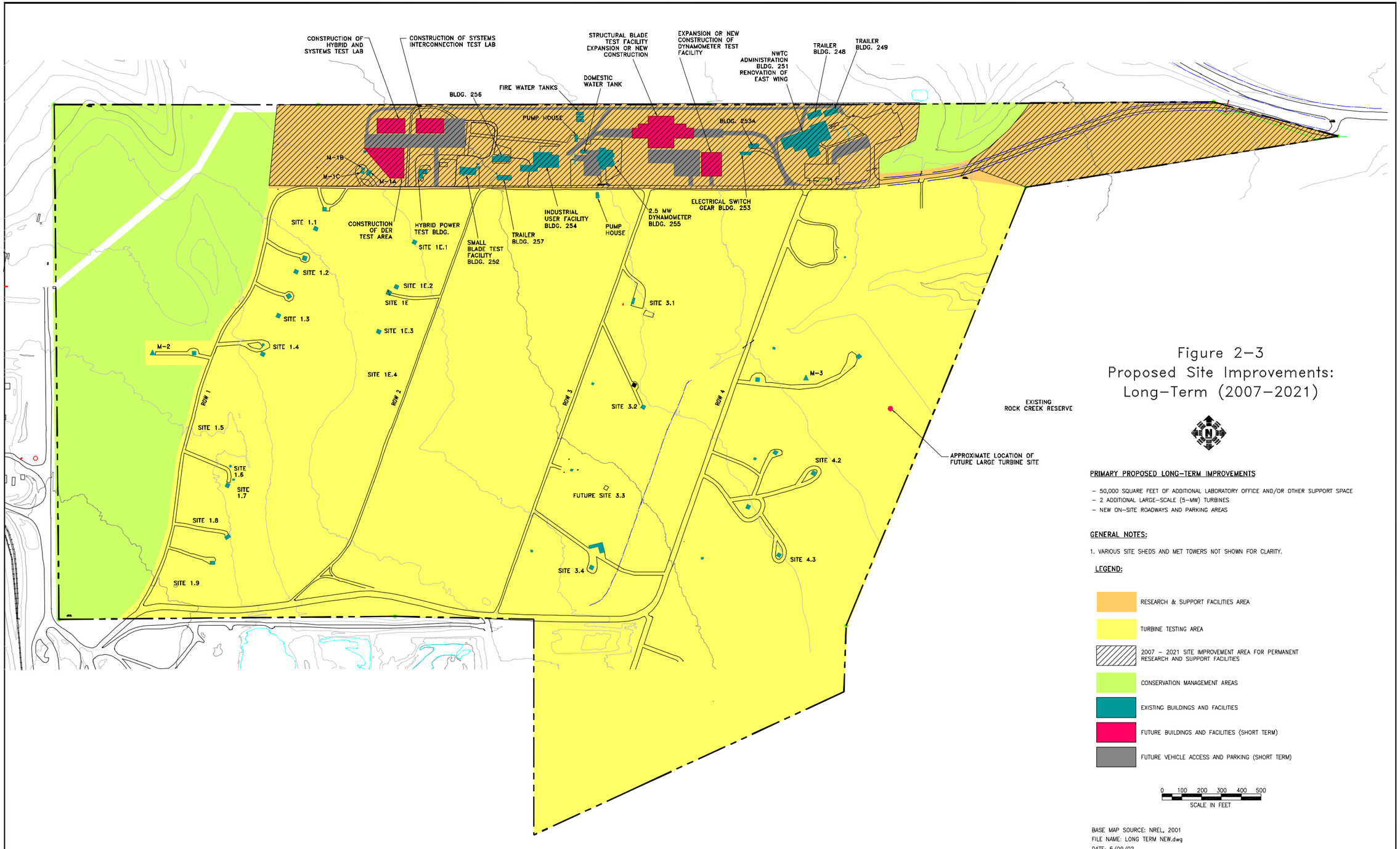

Figure 2–3
Proposed Site Improvements:
Long–Term (2007–2021)

PRIMARY PROPOSED LONG–TERM IMPROVEMENTS

- 50,000 SQUARE FEET OF ADDITIONAL LABORATORY OFFICE AND/OR OTHER SUPPORT SPACE
- 2 ADDITIONAL LARGE–SCALE (5–MW) TURBINES
- NEW ON–SITE ROADWAYS AND PARKING AREAS

GENERAL NOTES:

1. VARIOUS SITE SHEDS AND MET TOWERS NOT SHOWN FOR CLARITY.

LEGEND:

- RESEARCH & SUPPORT FACILITIES AREA
- TURBINE TESTING AREA
- 2007 – 2021 SITE IMPROVEMENT AREA FOR PERMANENT RESEARCH AND SUPPORT FACILITIES
- CONSERVATION MANAGEMENT AREAS
- EXISTING BUILDINGS AND FACILITIES
- FUTURE BUILDINGS AND FACILITIES (SHORT TERM)
- FUTURE VEHICLE ACCESS AND PARKING (SHORT TERM)

0 100 200 300 400 500
SCALE IN FEET

BASE MAP SOURCE: NREL, 2001
FILE NAME: LONG TERM NEW.dwg
DATE: 5/09/02

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